

Tapping a new source of delivery

Future engineers: Water

By Margo Cole

The first few months of the water industry's latest five year spending period have highlighted the changing priorities within the industry, and the challenges this presents for consultants and contractors working in the sector.

But water is not alone. Everyone working to deliver infrastructure to an increasingly urbanised global population is aware of the challenges this presents.

"As engineers, our job is to solve the big problems that are facing the world – like clean water and sanitation, energy and public health – against a background of diminishing resources and increasing population," says MWH UK managing director Catherine Schefer. "The problem-solving skills that we associate with good engineers are as vital as ever; but to address these huge global challenges, we need other skills and attributes, particularly the ability to collaborate, to question the traditional ways of doing things, and to be open to new ideas."

Among those "traditional ways of doing things" that are no longer viable is the hierarchical – and

sometimes adversarial – way in which delivery is managed. According to MWH Treatment managing director Paul Bresnan, the days of traditional relationships between client, designer, contractor and supply chain are long gone, and all parties have to be far more integrated and collaborative if the problems Schefer talks about are to be tackled successfully. "Collaboration has been talked about for years, but now it really has to happen if we are to stand a chance of delivering the infrastructure that is needed," he says. "Everyone who works within the sector should be confident in what they bring to the party, and be open to what other people bring."

In many ways the water sector is ahead of other sectors of the infrastructure industry, as MWH Europe Africa design director Ian Davies explains: "The UK water sector was privatised in 1990, and has had massive investment since then, a lot of which was in response to new regulatory challenges and historical lack of investment. As a result, we have had 25 years of creating new assets."

"To a great extent that major rebuild programme is now complete, which means that going forward we won't see massive investment in brand new facilities. There will be similar levels of investment, but now the emphasis is on making these assets really shining in terms of operational

APPRENTICES

Training: MWH is starting up apprenticeships in its consulting arm



performance and efficiency.

"I am absolutely convinced that we will still need engineers, but it will not be so much about designing and building new facilities; it's about getting more out of the existing asset base."

MWH Treatment engineering director Tom Standing says water companies are expecting something different from consultants and contractors in AMP6, the asset management programme that began earlier this year: "There's a change in the way some of our clients have engaged us. We all need to deliver programmes with a



Schefer: Developing new skills mix



The post-recession period has seen an increase in apprenticeships in the contracting side of the UK infrastructure sector. Increasingly, however, consultants are also seeing the benefits of employing young people straight out of school and putting them through an apprenticeship programme.

MWH is one such company. Following the success of apprenticeships in its contracting division MWH Treatment, the consultancy side of the business has developed an engineering technical support apprenticeship, and took on the first 11 apprentices for the programme earlier this year. The new recruits range in age from 17 to 22, and arrived at MWH with a variety of different qualifications, from GCSEs to BTEC and HNDs. Most have studied science or maths at some level, but beyond that, they have a broader range of subject interests than traditional graduate recruits.

"Some of the apprentices have done AS levels in things like law, and health & social care," says MWH civil engineer Rachel Meadwell who was involved in the interview process. "What matters is that they're interested in solutions to problems. And, because there's a lot of design

involved, we also need people who have skills in visualisation and creativity."

The apprenticeship programme lasts three years, during which the trainees will learn a wide range of skills from producing CAD models to carrying out health & safety risk assessments. After that, they will have the opportunity to continue training if they want to.

Meadwell herself joined MWH as a CAD technician 10 years ago after taking A-levels in art, textiles and maths. Since working with MWH, she has gained an ONC, an HNC and a BSc in civil engineering, and is currently working towards chartership, as well as being line manager to one of the apprentices who has just started the new programme. »



Meadwell: Solutions emphasis

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Catherine Schefer, UK managing director, MWH

20% to 25% efficiency, but increasingly against outcomes rather than just outputs. Couple that with a greater focus on totex means we are going to have to do things differently – and that requires different thinking and a different approach.

"The way we used to do things – designing in isolation – we can no longer afford that. Clients don't want consultants to do a design and contractors and suppliers to revisit that. As a result, the engineer is much more of an integrator, a facilitator and collaborator to the client, the contractor and the

supply chain, and that requires a different set of skills."

In this AMP period, which runs from 2015 to 2020, water regulator Ofwat expects water companies to move away from ticking regulatory boxes and instead be judged on the service they deliver to customers. Cost efficiency is high on Ofwat's agenda, and water companies are being encouraged to consider the total cost (so-called "totex") of a solution, rather than separating the capital and operating costs. As a result, there is much more emphasis on looking at the way an entire network operates, and finding the

most appropriate place in that network to make an intervention that will bring benefits – be they financial, environmental or in terms of the reliability of the service customers get.

"That's going to require a different skill set," says Standing, "people with natural connectivity, and collaboration and facilitation skills."

A key aspect of Ofwat's focus – and, increasingly, other infrastructure procurement organisations – is a move away from scope-based contracts to outcome-based contracts, which MWH Treatment project manager Maria Gonzalez »

FRANKLEY WATER TREATMENT WORKS



Upgrade programme: Digitally rehearsed

The use of modelling and visualisation technology is already changing design and construction methods, and this will only increase as a generation that has grown up with sophisticated gaming and animation tools moves up through the industry.

MWH Treatment has been using 4D computer models to “digitally rehearse” critical installations on its project to upgrade a water treatment works in Birmingham, and claims the technique has resulted in safer – and calmer – assembly on site.

MWH Treatment is working on the £14M upgrade of the Frankley water treatment works west of Birmingham, a project that involves building a new lime water dosing facility within the existing plant. The JV and client Severn Trent Water wanted to maximise off site production, as they felt it would bring programme and quality benefits, as well as being safer and more efficient than traditional construction. By involving key subcontractors from the outset, around 85% of the new elements have been fabricated off site, including the de-alkalisation plant, pumps, steel tanks and plastic chambers.

As a result, the “construction” phase of the project has largely been replaced by an “installation” phase, with all the

important installations being rehearsed in a digital environment before they were carried out on site. During the rehearsals, the 3D model that the main suppliers were all using for their design was fed into software that adds a fourth dimension: time.

“The use of digital rehearsals allows fully inclusive and collaborative planning with all parties from the supply chain, the site team and the designers; and it enables designs to be reviewed through an “installation filter”, so changes can be made to aid installation, explains MWH Treatment project manager Richard Clarke.

“It also enables failure scenarios to be rehearsed, so if plan B is needed, all parties are rehearsed, which removes the need to make decisions under pressure.”

He says that digital rehearsals also speed up the “learning cycle”. “Previously, lessons learnt would be from one project to the next, which could be months or even years apart. With digital rehearsal, the lessons learnt are trialled in the digital environment, and are fed back into the actual installation of the current project, which is a huge leap forward in right first time.”

Clarke says that the result of doing digital rehearsals at Frankley was that “there was total calmness on a complex installation.”

» Rodriguez believes is a positive change for the engineers in her team. “We’re moving towards a world of outcomes, and I think that gives more of a sense of purpose to the engineering we do,” she says. “We have to rethink what success looks like. Before, it was a pipe from A to B; now it is clean water for a number of people, and we have to consider every possible solution.

“The solution might not involve designing a great big thing. It might be to do nothing, or to do something completely different elsewhere. But that means design engineers may not be as involved in the design of a specific asset – more in challenging the solutions.”

Davies says this means the industry will have to change its recruitment strategy. “In the past, we would attract people with images of great big new iconic facilities,” he says.

“There are other sectors out there that will have the big iconic facilities – like Crossrail and the new nuclear programme – but we have to be honest and talk instead about the exciting opportunities we can provide.

“I do think we’ve got a unique opportunity to attract people who are driven and motivated by sustainability, by environmental stewardship, and by public health.”

This change in perspective



“There’s a change in the way some of our clients have engaged us. We all need to deliver programmes with a 20% to 25% efficiency, but increasingly against outcomes rather than just outputs”

Tom Standing,
engineering director,
MWH Treatment

coincides with a shortage in the number of engineers entering the industry through the traditional graduate route, which in itself is encouraging consultants and

NORTHUMBRIAN WATER FLOOD ALLEVIATION

AMP6 is set to be characterised by water companies focusing on outcomes and customer benefits.

Evidence of what this might mean in practice comes from Killingworth and Longbenton in North Tyneside, where Northumbrian Water has been working in partnership with the Environment Agency and North Tyneside Council to manage flood risk.

Flooding within the catchment area is caused by a combination of factors, each of which is the usually the responsibility of a different organisation or body. In the past, each of these organisations would have developed its

own solution in isolation, but Northumbrian Water was keen to develop a catchment-wide solution that involved all parties.

“In this catchment there are multiple modes of flooding – rivers and watercourses, surface water from the roads, and Northumbrian Water’s own assets,” explains MWH client service manager Ben Clark, who is working with Northumbrian Water on the project. “By involving all the relevant organisations in one scheme, you not only reduce the amount of disruption, and have more efficient construction, but you can also unlock far wider benefits for the community.”

contractors to look at employing young people from more diverse backgrounds. "We have got a well established graduate recruitment and development programme, and MWH Treatment [the contracting arm] takes on apprentices. Consultancy organisations tend to go more for graduates, but this year we have also launched an apprenticeship programme for 16 and 17 year olds."

One thing the new generation of engineers brings with them is an almost innate ability to use the modern communications tools and technology that are transforming the way engineering projects are conceived, promoted, designed, procured and built.

"Graduates now have grown up all through their lives knowing the internet, using social media, learning gaming skills," says MWH Treatment head of safety, health, environment and quality Paul Marsden.

"By the time they get to my age, they will be coming into leadership roles knowing nothing else. They will expect to be using digital models to help build on site. This is a complete step change.

"They also understand globalisation in a different way," he adds.

"They can just as easily be talking to someone in Australia, or America,

or Europe; and they want to be able to collect good ideas from around the world."

Marsden also believes younger people are more likely to challenge conventional solutions. "We're more of a challenging society now," he says. "If you've got the culture right within the company or a joint venture you can challenge more and think outside the box – and that's what we need."

The challenge of making the best of limited resources is not confined to the water sector. "As we've gone through the industrial revolution, the asset base that we as a society have to support has got bigger and bigger," explains Andrew Cowell, who is BIM strategy and implementation lead for the eight20 alliance that is delivering Thames Water's AMP6 programme. "As engineers we are going to have to help society work through some of these hard choices – what are we willing to pay for. As a result, the role of the engineer has to become broader in the economy: we have to be involved in the financial decisions and communicating with the general public.

"The more urbanisation we see, the more the value of the engineer – both the technical engineer and the engineer in society more generally – is going to increase. "

TYSELEY BIOMASS POWER PLANT

Cradle to grave: Engineer, procure construct project



MWH's involvement in a biomass power project in Birmingham demonstrates two areas of capability that are set to become ever more important: increased awareness and the ability to integrate the supply chain.

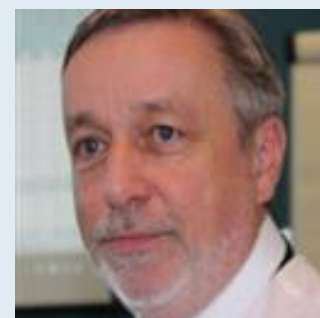
The project has seen MWH not only design the 9MW scheme, but also formulate the engineer, procure, construct (EPC) commercial package and deliver on site. The plant in Tyseley, on the south side of Birmingham, is set to start generating electricity in February 2016, using advanced gasification technology to derive energy from waste wood.

Once it is complete, MWH will take on an operation and maintenance role for the facility for five years for the scheme's developer Carbonarius.

"The biggest risks to the successful delivery are with the interface management," explains MWH technical director

for waste and energy Mike Crane, emphasising the role of future engineers as integrators and facilitators. Some of the technology is being used for the first time in Europe, but we can't take any risk on process.

"We expect our engineers to be even more commercially aware," he adds. "Our clients are finance houses and developers, so we've gone for rock solid, safe solutions first. The priority is safe delivery, but we are conscious of cost. If we come up with a solution that's too expensive for our client, it won't happen."



Crane: Commercial awareness



Clark: Stakeholder involvement

In this instance, there is a clear, desirable outcome: to stop surface water flooding for the affected communities. By involving all the stakeholders with an interest in achieving that outcome, the scheme has generated partnership funding that might not otherwise

have been available.

The scheme involves creating a range of sustainable drainage solutions (SuDS) across the catchment.

"There has definitely been a move away from grey engineering – big concrete tanks below ground – to green, sustainable solutions," says Clark, who says these sustainable solutions also provide wider benefits to the local community.

"Not only are they more environmentally friendly, they also yield more for stakeholders, because they create environments for people and communities," says Clark.